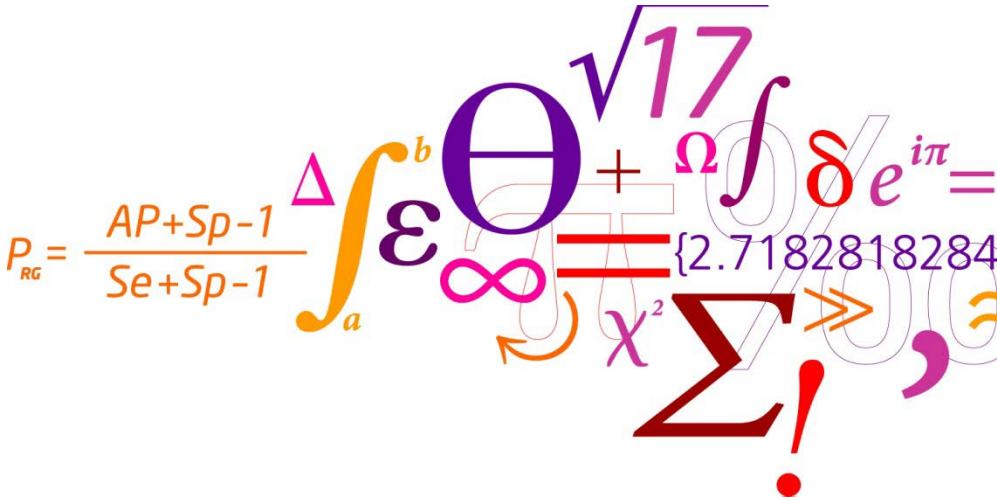
Spatio-temporal abundance of Culicoides on a local scale

Kirkeby, Carsten; Bødker, Rene; Stockmarr, Anders; Lind, Peter

Publication date:
2013

Spatio-temporal abundance of *Culicoides* on a local scale

Carsten Kirkeby
René Bødker
Anders Stockmarr
Peter Lind



DTU Vet
National Veterinary Institute

Introduction

Culicoides

- ♀suck blood
- 500 species ~ 40 in Denmark
- 1-2mm
- **Parasites:** protozoans, nematodes

Institute of Animal Health UK

- **Virus:** Bluetongue, African Horse Sickness, Akabane Virus, Schmallenberg…

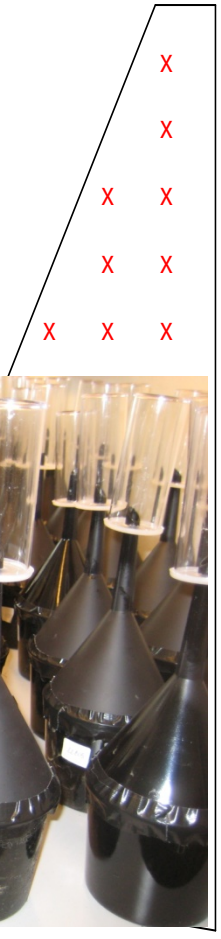
Aim

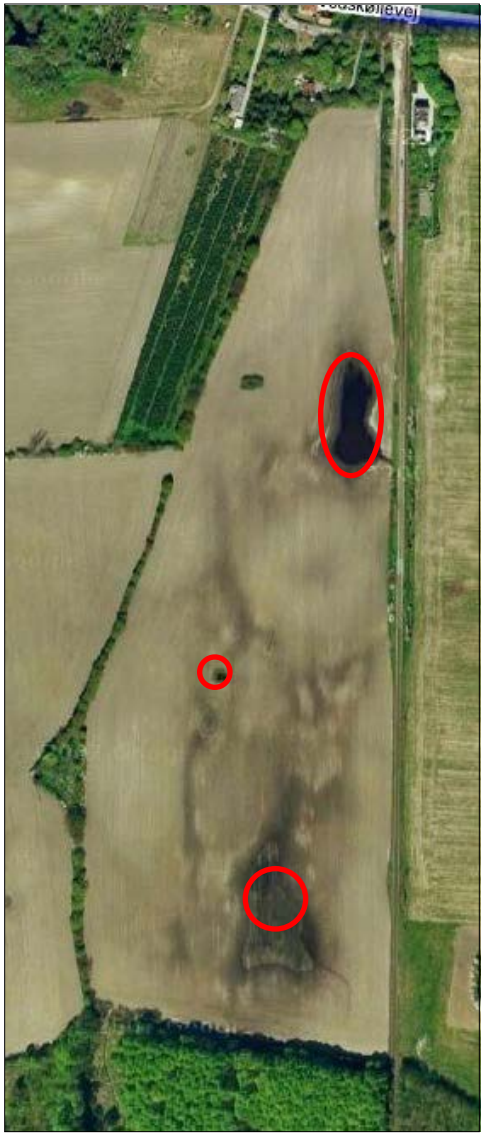
- Local scale abundance:
  - Spatial factors?
  - Temporal factors?
- Predictable?

Institute of Animal Health UK

Field work

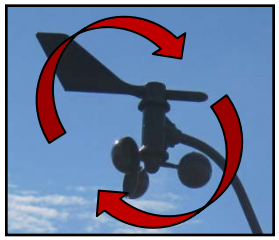
- 50 light traps – 50*50 m grid
- Distance to breeding sites
- Temperatu
- Wind spee





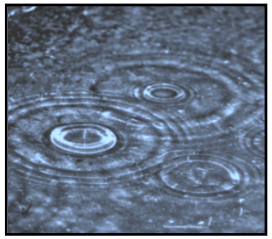
Field work

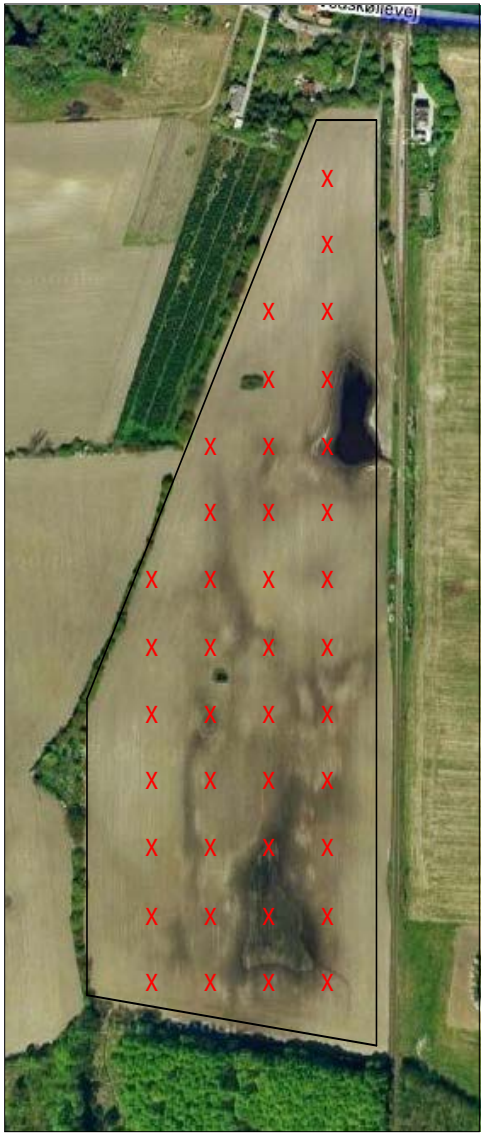
- Turbulence



- Humidity

- Precipitation



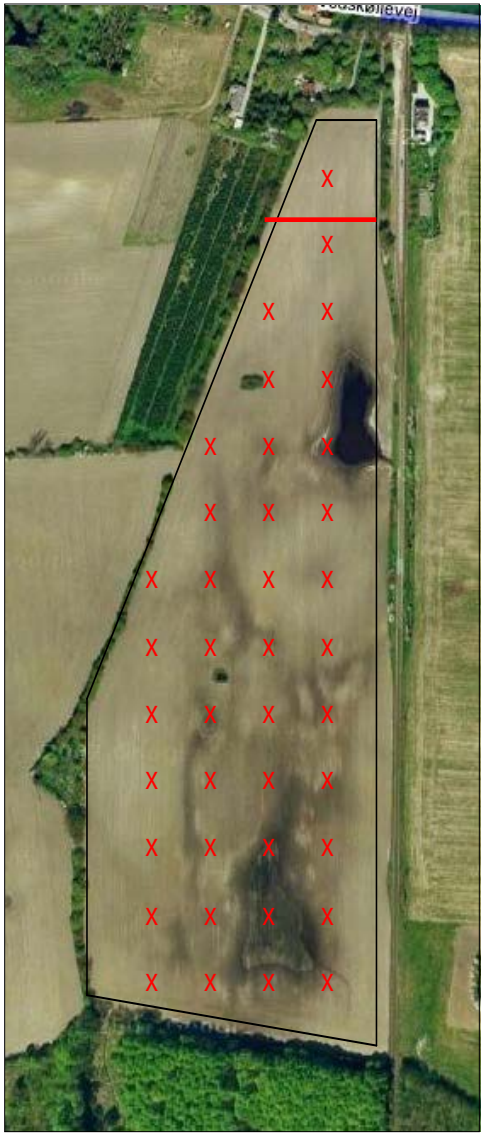


Field work

- Host animals

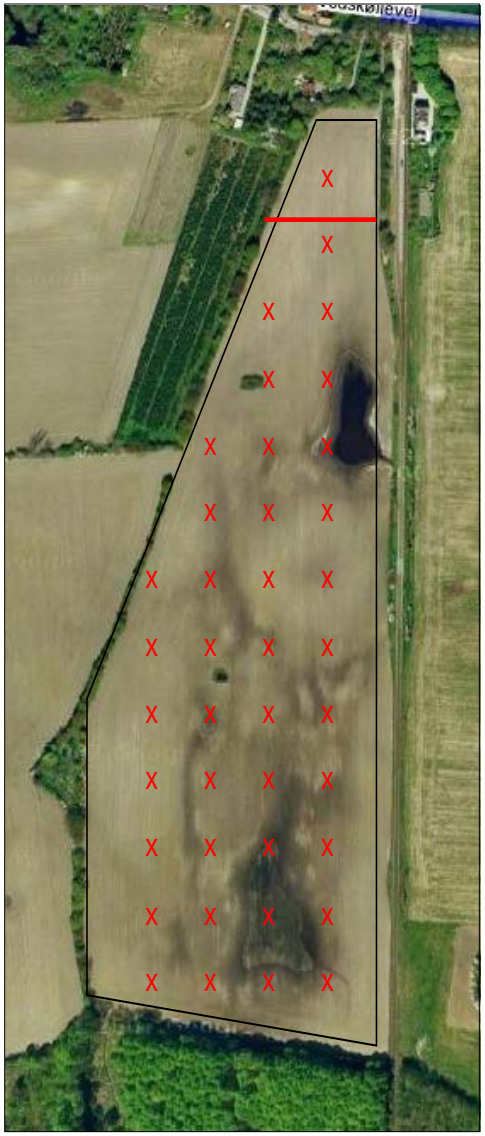
- Windbreaks

- Transect of sheep



Field work

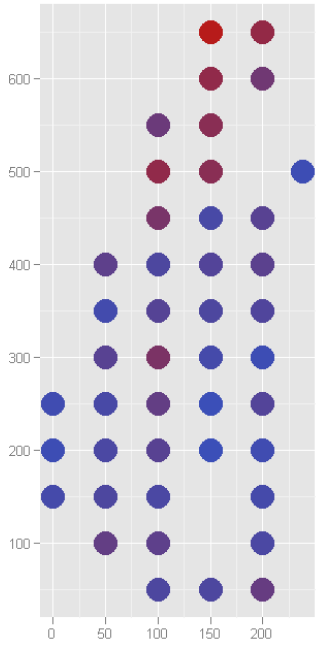
- Sheep transect

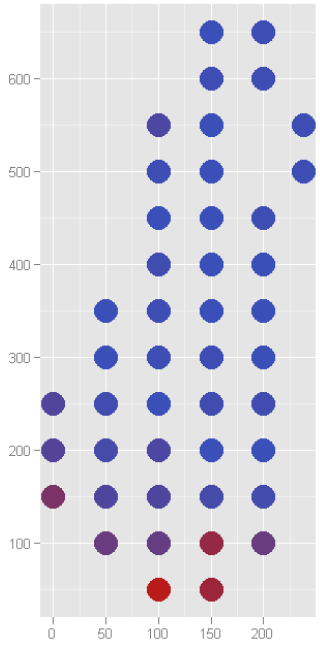


Catches

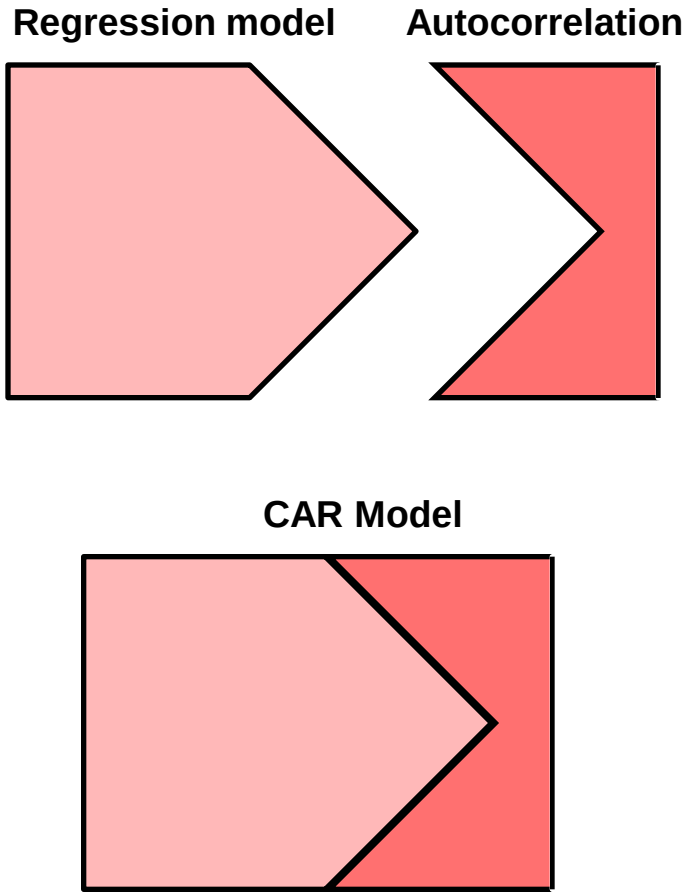
- 16 catch nights * 50 light traps ~ 800 samples

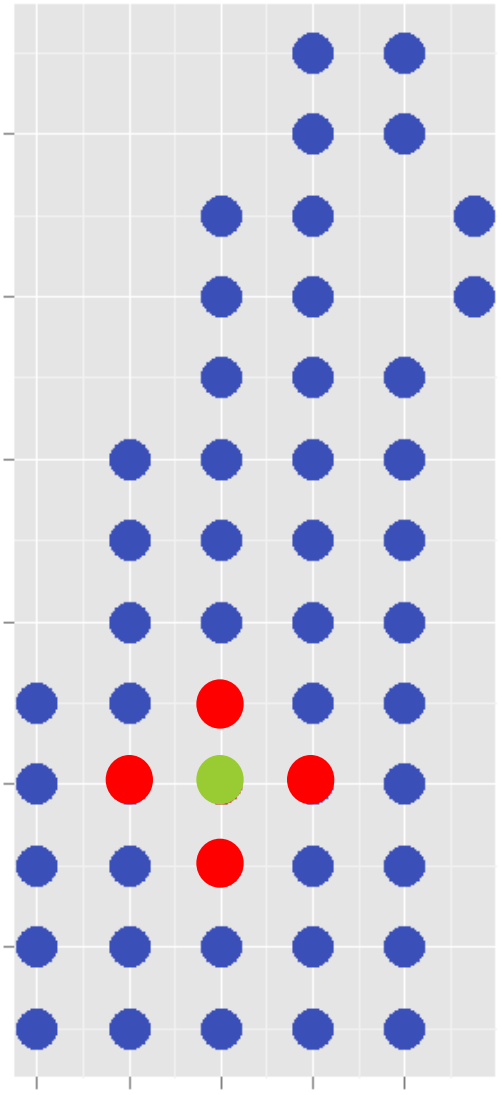
Cacth night	A1	A2	B1	C1	C2	C3	E1	E2	E3	F1	F2	F3	F4	G1	G3	G4
***Obsoletus* group**	4	872	316	173	522	612	2	93	95	29	427	1086	1	253	2	1
***Pulicaris* group**	15	8015	1524	750	621	952	4	190	223	33	817	1745	8	260	5	4





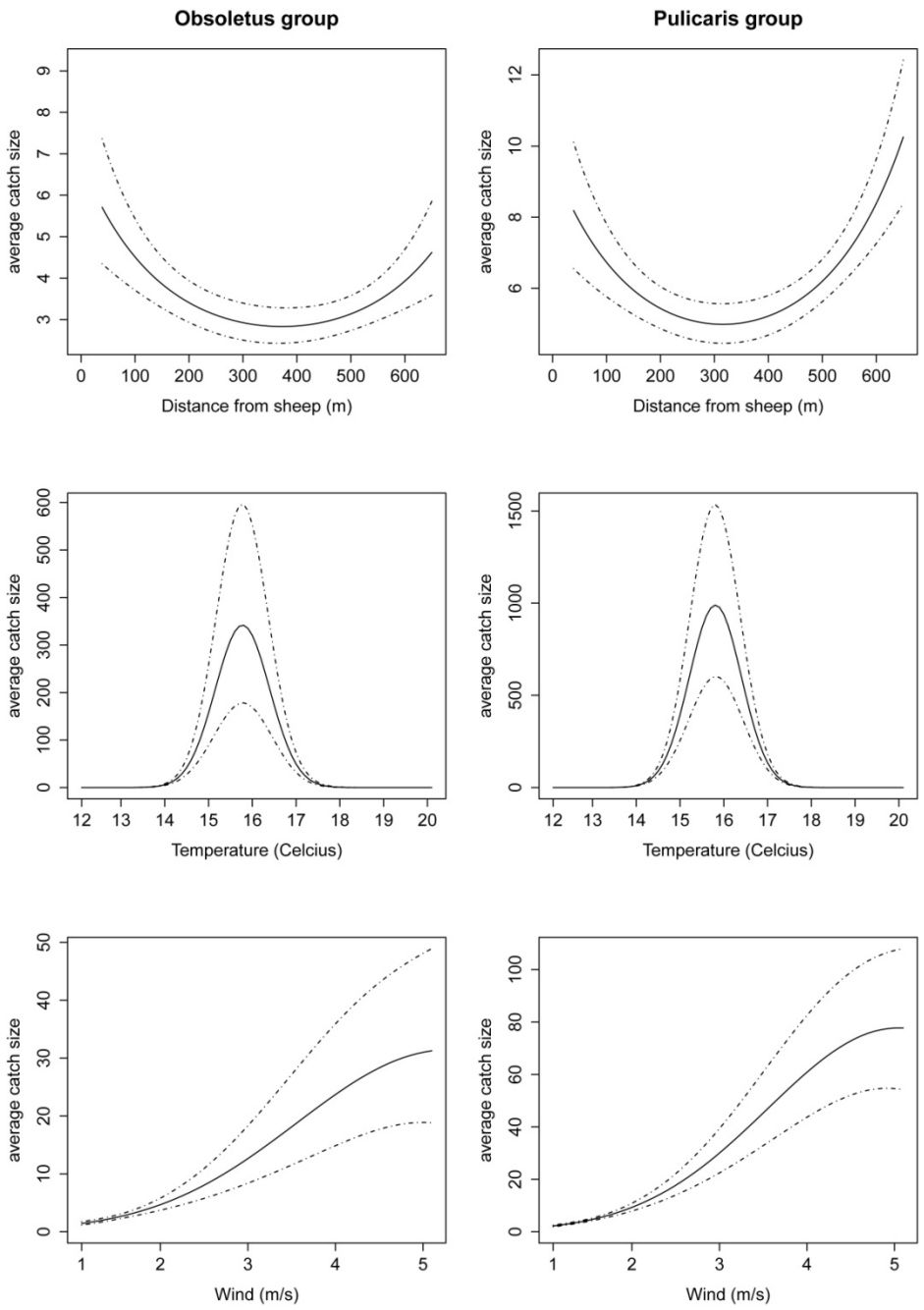
Modeling





Results

- Distance to sheep
- Temperature
- Wind speed



Results

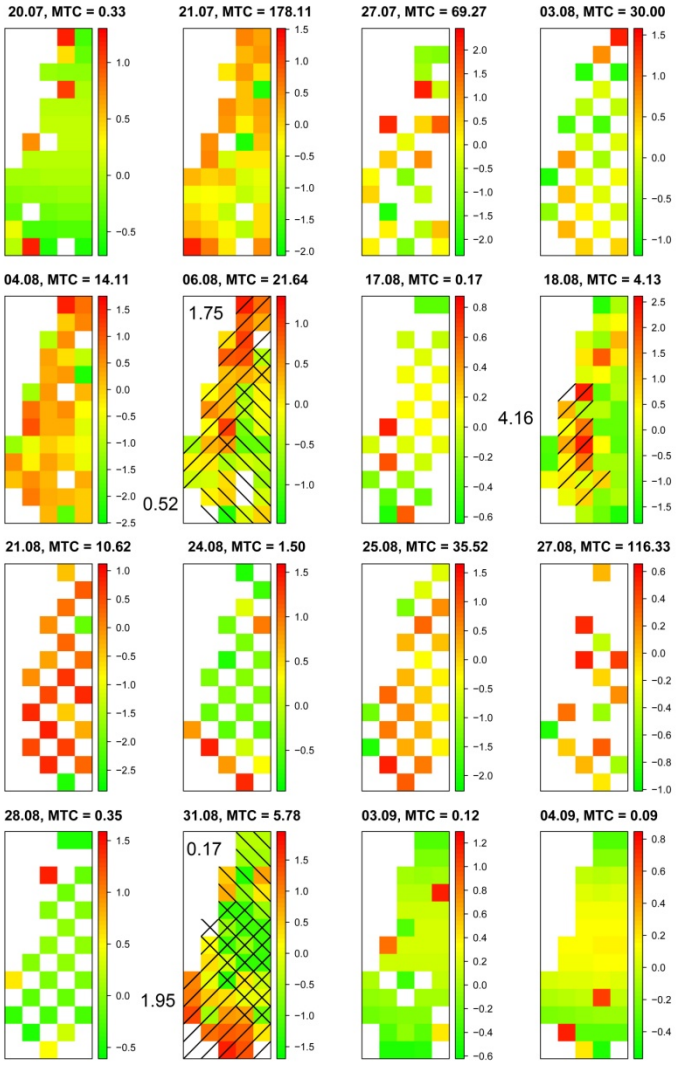
- Turbulence
- Humidity
- Precipitation
- Sheep transect

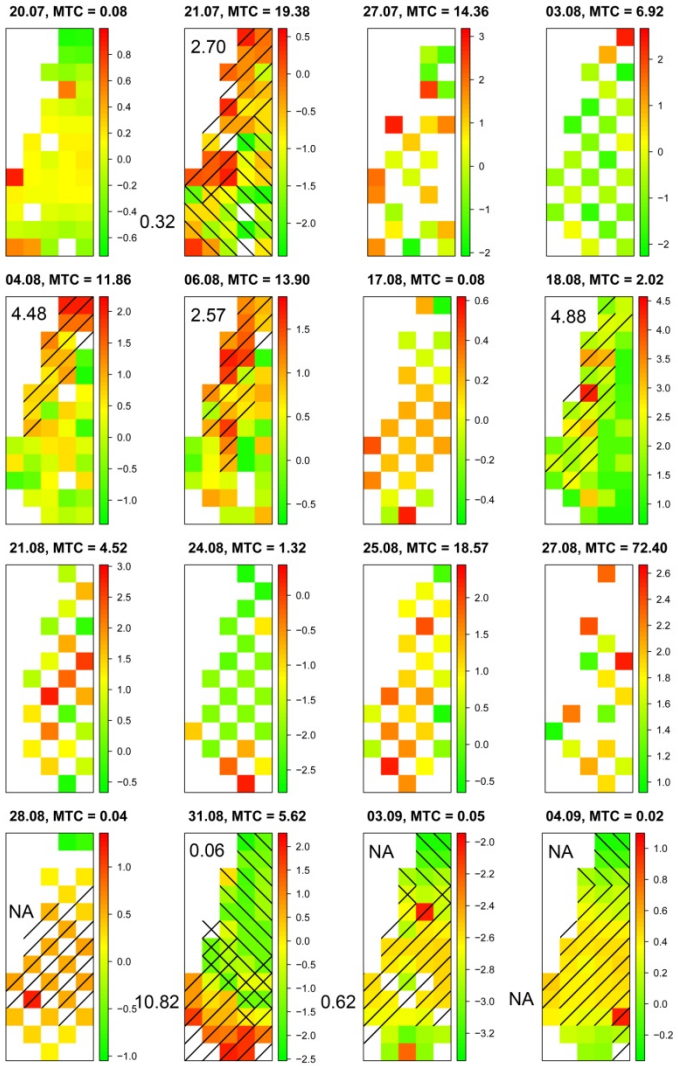
	Ordinary regression				CAR models			
	Obsoletus group		Pulicaris group		Obsoletus group		Pulicaris group	
Intercept	0.73		0.43		-349		-386	
Distance to sheep	$-4.5 \cdot 10^{-3}$	***	$-3.4 \cdot 10^{-3}$	***	$-4.7 \cdot 10^{-3}$	***	$-4.05 \cdot 10^{-3}$	***
Distance to sheep^2	$6.0 \cdot 10^{-6}$	***	$5.7 \cdot 10^{-6}$	***	$6.3 \cdot 10^{-6}$	***	$6.42 \cdot 10^{-6}$	***
Precipitation	NS		NS		−66.2	***	−73.40	***
Turbulence	NS		NS		−186.2	***	−206.6	***
Humidity	NS		NS		1.06	***	1.19	***
Temperature	NS		NS		39.95	***	43.91	***
Temperature^2	NS		NS		−1.27	***	−1.40	***
Wind speed	$-7.6 \cdot 10^{-4}$	*	NS		1.84	***	2.27	***
Wind speed^2	NS		NS		−0.18	**	$-0.23 \cdot 10^{-2}$	***
Sheep transect	NS		0.51	*	NS		0.4794	*
Windbreaks	−0.28	*	$-9.7 \cdot 10^{-2}$	***	NS		NS	
Sheep scent	-7.116	***	0.81	*	NS		NS	
Windbreaks * Sheep scent	$4.8 \cdot 10^{3}$	***	2077	*	NS		NS	
Wind speed * Sheep scent	-84.96	*	NS		NS		NS	
Catch night 21.07	2.68		4.84		-0.56		1.06	
Catch night 27.07	2.06		3.60		-4.24		-3.32	
Catch night 03.08	1.09		3.05		59.64		67.31	
Catch night 04.08	1.96		2.22		221.60		245.30	
Catch night 06.08	2.37		2.81		21.86		24.59	
Catch night 17.08	0.01		-0.04		-9.51		-10.76	
Catch night 18.08	0.73		1.09		-5.48		-5.92	
Catch night 21.08	1.34		2.11		108.80		120.60	
Catch night 24.08	0.36		0.38		NA		NA	
Catch night 25.08	2.72		3.17		NA		NA	
Catch night 27.08	4.11		4.56		NA		NA	
Catch night 28.08	-0.07		0.02		NA		NA	
Catch night 31.08	1.09		1.26		NA		NA	
Catch night 03.09	-0.05		-0.08		NA		NA	
Catch night 04.09	NA		-0.06		NA		NA	
Residual variance	0.68		0.65		0.69		0.65	

Results

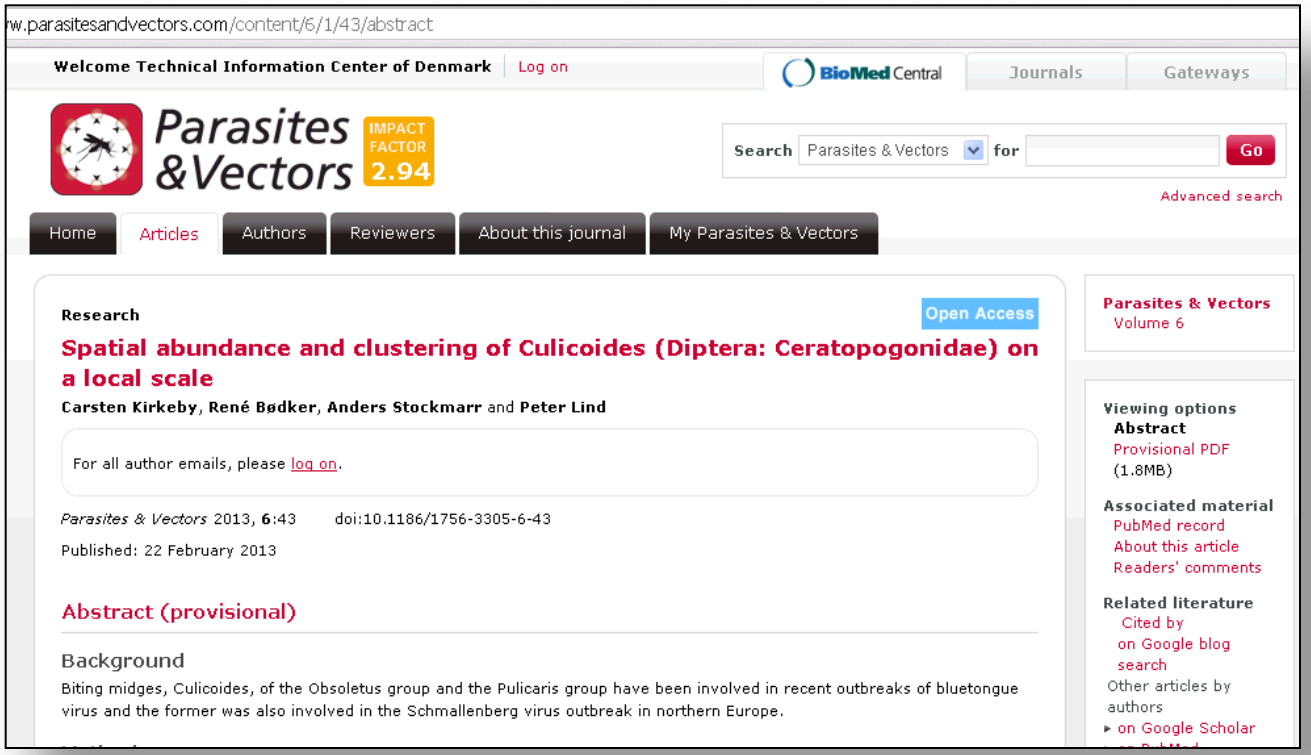
- Uncertainty: 20% – 300%
- Significant spatial autocorrelation
- Temporal autocorrelation insignificant
- Dynamic pattern: 4 or 11 times higher abundance

Results


20.07, MTC = 0.33
21.07, MTC = 178.11
27.07, MTC = 69.27
03.08, MTC = 30.00
04.08, MTC = 14.11
06.08, MTC = 21.64
1.75
17.08, MTC = 0.17
18.08, MTC = 4.13
4.16
0.52
21.08, MTC = 10.62
24.08, MTC = 1.50
25.08, MTC = 35.52
27.08, MTC = 116.33
28.08, MTC = 0.35
31.08, MTC = 5.78
0.17
03.09, MTC = 0.12
04.09, MTC = 0.09
1.95


20.07, MTC = 0.08
21.07, MTC = 19.38
2.70
27.07, MTC = 14.36
03.08, MTC = 6.92
0.32
04.08, MTC = 11.86
4.48
06.08, MTC = 13.90
2.57
17.08, MTC = 0.08
18.08, MTC = 2.02
4.88
21.08, MTC = 4.52
24.08, MTC = 1.32
25.08, MTC = 18.57
27.08, MTC = 72.40
28.08, MTC = 0.04
NA
31.08, MTC = 5.62
0.06
03.09, MTC = 0.05
NA
04.09, MTC = 0.02
NA
10.82
0.62
NA

Read more


w.parasitesandvectors.com/content/6/1/43/abstract
Welcome Technical Information Center of Denmark
Log on
BioMed Central
Journals
Gateways
Parasites &Vectors
IMPACT FACTOR 2.94
Search
Parasites & Vectors
for
Go
Advanced search
Home
Articles
Authors
Reviewers
About this journal
My Parasites & Vectors
Research
Open Access
Spatial abundance and clustering of Culicoides (Diptera: Ceratopogonidae) on a local scale
Carsten Kirkeby, René Bødker, Anders Stockmarr and Peter Lind
For all author emails, please log on.
Parasites & Vectors 2013, 6:43
doi:10.1186/1756-3305-6-43
Published: 22 February 2013
Abstract (provisional)
Background
Biting midges, Culicoides, of the Obsoletus group and the Pulicaris group have been involved in recent outbreaks of bluetongue virus and the former was also involved in the Schmallenberg virus outbreak in northern Europe.
Parasites & Vectors
Volume 6
Viewing options
Abstract
Provisional PDF
(1.8MB)
Associated material
PubMed record
About this article
Readers' comments
Related literature
Cited by
on Google blog search
Other articles by authors
on Google Scholar

Thank you

Questions are welcome

Carsten Kirkeby

ckir@vet.dtu.dk